

CLASSIFICATION OF SOME BIRD COMMUNITIES IN CHIANG MAI PROVINCE, NORTHERN THAILAND

Ookeow Prakobvitayakit Beaver and Narit Sritasawan**

A B S T R A C T

This study examines the bird communities of the mountain areas in Chiang Mai Province, northern Thailand, using presence-absence distribution data.

The richest community (143 species) was found in submontane evergreen broad-leaved forest on Doi Inthanon at 1600 m. The summit area (2590 m) supported fewer species than did areas of drier, lower elevation forest on Doi Pui-Suthep, from 300 to 1685 m. It is suggested that bird species diversity could be interpreted primarily in terms of vegetational complexity.

Limited habitat disturbance may enhance diversity through creating artificial edge habitats and clearings.

I N T R O D U C T I O N

Thai ornithologists have only in recent years paid attention to the ecological aspects of avifaunas. Logging, burning, and shifting cultivation not only cause the ecological problems of erosion and rapid water runoff but also are endangering many native species of the flora and fauna through destruction of their natural habitats. Chiang Mai is one of the best areas in Thailand for bird watching but it is also one of the areas experiencing most serious modification by man. An understanding the distribution of birds in various environmental situations may lead to better methods of park or habitat management. In this paper we describe the structure of several habitat types and report on the distribution of birds in them. The following questions are also considered:

1. How much variation exists and what factors control species richness in the selected study areas?
2. To what extent do bird communities reflect the structure of the habitat?
3. How much impact has man had on these bird communities?

S T U D Y A R E A S

Chiang Mai is located in northern Thailand (Fig. 1). All 6 sites studied are in the watershed of the Maenam (River) Ping in Chiang Mai Province.

* Department of Biology, Chiang Mai University, Chiang Mai 50002, Thailand.

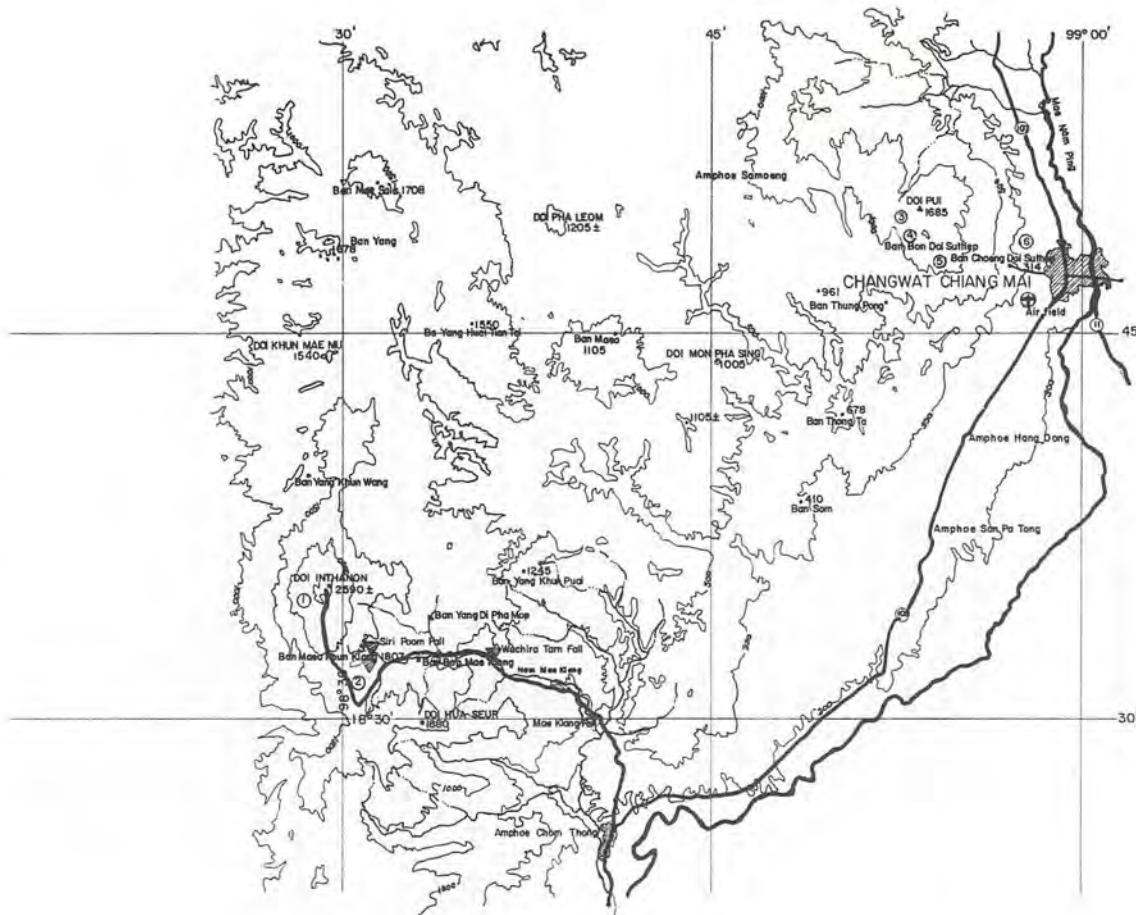


Figure 1. Map showing part of Chiang Mai Province containing the study sites (circled numbers).

The study areas can be divided into two major types of environment: (1) the mountains, containing sites 1–5, (Fig. 2 and 3), and (2) the transition area between the mountains and the plain, containing site 6 (Fig. 3).

The climate of the area is monsoonal with marked wet and dry seasons. Doi Inthanon is in the centre of the northern region which has a uniform monsoon climate in which the heaviest rain coincides with the late south-west monsoon during Aug.–Sept. and the driest month, which is December, coincides with the dry northeast monsoon. The average annual rainfall for the northern region is about 1500 mm. Chiang Mai, the nearest weather station, has an annual total of 1344 mm. of rainfall of which only about 248 mm falls during the 6 months of the dry season (November–April).

Doi Inthanon is a granitic massif intruding into a range lying about 60 km southwest of the city of Chiang Mai. It forms the divide between the Ping and Chaem Rivers, giving rise to Kuantan sandy loams of shallow coarse and stony soils. Over the rough mountainous terrain this soil type supports mixed forests, except where the hill tribes practice shifting cultivation of maize with rice cultivation along the streams.

The forest structure on Doi Inthanon changes with altitude. The study areas are at the elevation 2500–2590 m (site 1) which is the summit, and at the elevation 1600–1700 m (site 2).

Details of plant associations can be found in ROBINS & SMITINAND (1966).

Site 1 is lower montane forest. At 2590 m altitude, the forest consists of 4 storeys of vegetation strata: (1) the upper canopy, 25–30 m high; (2) the lower canopy, 20 m high; (3) shrub layer, 10 m high; (4) ground layer, consisting of herbs.

Site 2 is at 1600–1700 m altitude, with forest containing five storeys: (1) the upper canopy 35 m high; (2) the lower canopy 25 m high; (3) the upper shrub layer which is nowhere very dense; (4) the lower shrub layer; and seedlings.

Sites 3–6 lie on the connected mountains Doi Pui and Doi Suthep, which rise abruptly from the plains of Maenam Ping at about 300 m elevation. Their peaks rise to elevations of 1685 m and 1610 m, respectively. The mountains are severely dissected which greatly adds to their steepness. Some places are cliff-like, such as at Pa Dum, elevation 1400 m. In other places, especially at higher elevation on Doi Suthep, slopes are gentler and plateau-like. The details of physiognomy and the plant associations of this range can be found in KUCHLER & SAWYER (1968). The following descriptions are modified from theirs.

Site 3, Doi Pui, is at 1600–1680 m elevation. The forest consists mostly of tall and medium-tall broadleaf evergreen trees. At approximately 1685 m altitude, the forest can be divided into 4 storeys: (1) the upper canopy in which some trees may reach 42 m in height; (2) the layer of medium trees; (3) low trees and shrubs; (4) ground layer of tree seedlings and graminoids.

Site 4, Pa Dum-Puping Palace, is at 1400–1600 m elevation. The forest

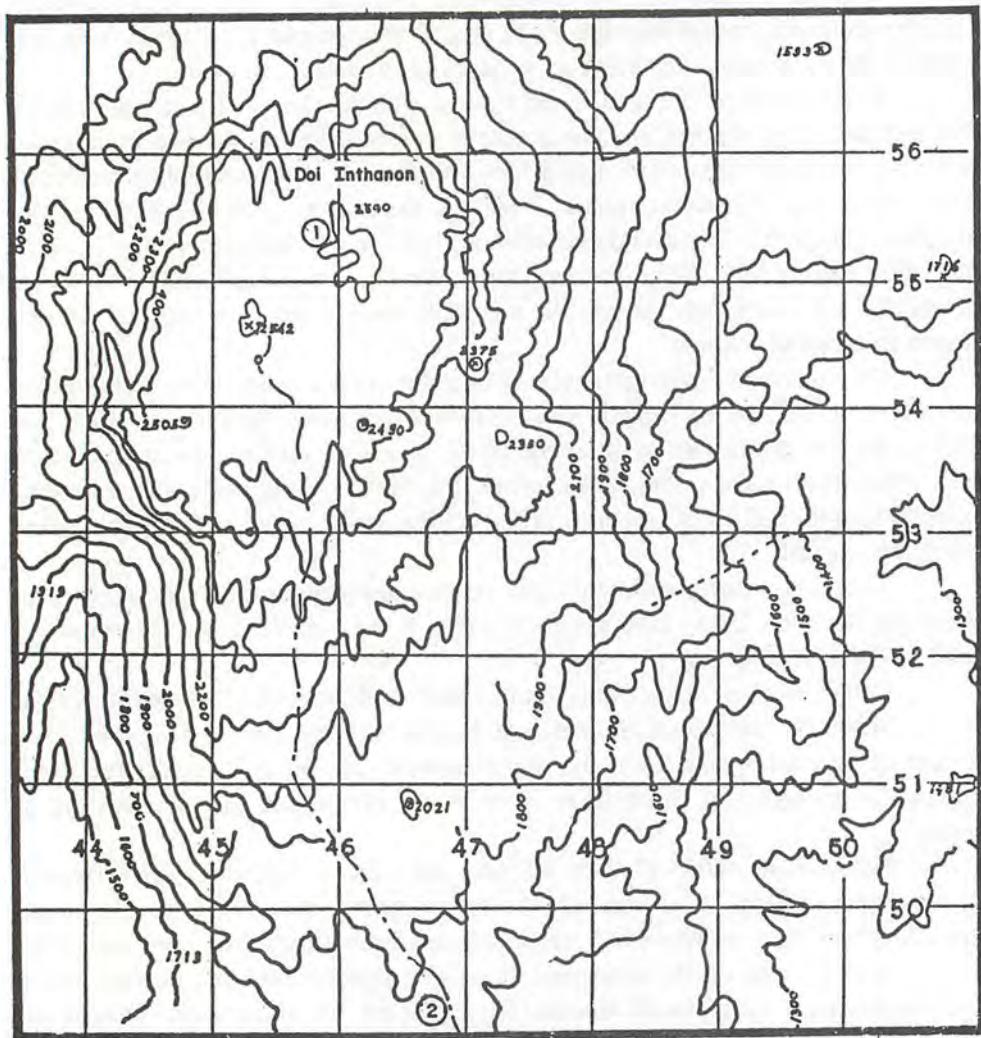


Figure 2. Locations of sites 1 and 2 (circled) on Doi Inthanon. Grid lines are 1 km apart; elevations are in metres.

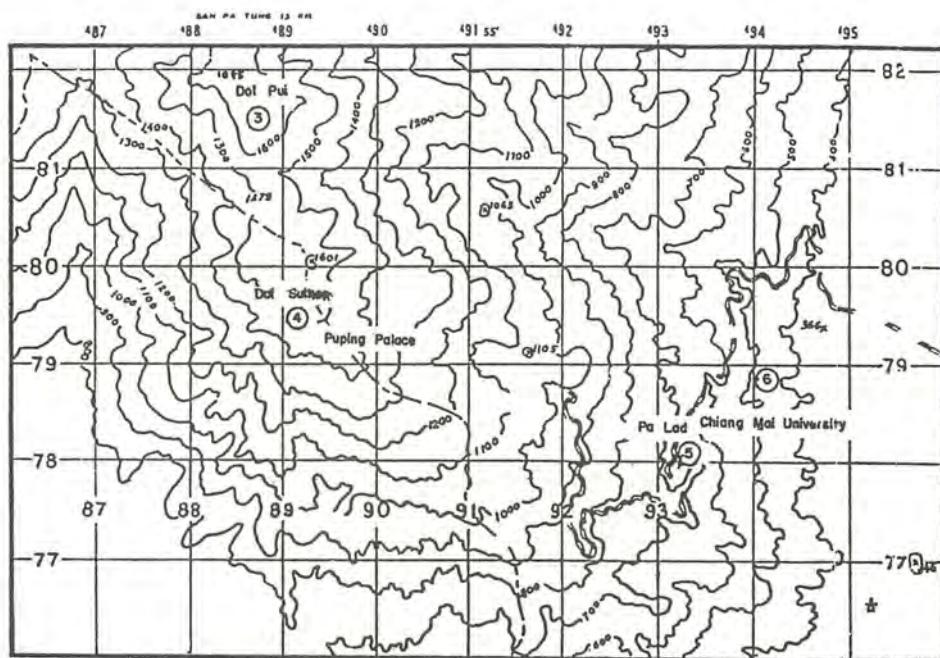


Figure 3. Locations of sites 3-6 on Doi Suthep – Doi Pui (circled numbers). Grid lines are 1 km apart; elevations in metres.

consists of tall and medium-tall broadleaf evergreen trees. There are 4 strata of vegetation as found in site 3.

Site 5, Pa lad, is at 500–670 m. The forest is dry dipterocarpous consisting of 3 strata of vegetation: (1) the upper canopy of medium-tall broadleaf trees; (2) low tree and shrub; (3) ground plants.

Site 6, at the foot of Doi Suthep on the Chiang Mai University campus, is at approximately 300 m elevation. The forest has been disturbed, and can be divided into 3 strata of vegetation: (1) the upper canopy; (2) low trees and shrubs; (3) ground layer.

Doi Inthanon, the highest mountain in Thailand, has a larger area of forest, cooler temperatures, deeper moisture-retaining soil and higher precipitation than Doi Pui-Suthep. Doi Pui-Suthep including Pa Lad Puping Palace (lower elevation of Doi Suthep) has drier forests with steeper slopes more exposed to erosion.

METHODS

Monthly observations were made in study sites 1–6 throughout the year (May 1982–April 1983). Data accumulated from sites 1–6 by Ornithology classes in the Department of Biology, Chiang Mai University, during migratory seasons

during 1978–1982 are also included. The observations were made when bird activity was high, during the morning from 7.00–11.00 a.m. and in the afternoon from 15.00–18.00 p.m. The paths taken by observers within each study area were selected on the basis of a preliminary survey, experience, and intuition. The observations were made in the same areas each time. Bird identification is based on LEKAKUL & CRONIN (1974).

A comparison of avifaunas in the study sites has been done using the similarity indices of Mountford (SOUTHWOOD, 1978). The indices permit comparison between all possible pairs of sites to generate a hierarchy of sites based on faunal similarity. One index is based on the sum of the numbers of species found in two sites:

$$I_s (AB) = \frac{j}{a + b}$$

The following index is based on number of species found in either of two sites (without counting any species twice) :

$$I_j (AB) = \frac{j}{a + b - j}$$

where
 a = the number of species found in site A
 b = the number of species found in site B
 j = the number of species found in both sites.

The sites were then fused into groups following MOUNTFORD'S (1962) procedure. This involved fusing the pair of sites with the highest similarity index and then recalculating new similarity indices between the new group and each of the other sites using the new index given below. This procedure was repeated until all groups were fused together.

The index between groups A_1, A_2, \dots, A_m and B_1, B_2, \dots, B_n is given by :

$$I (A_{1...m} : B_{1...n}) = \frac{1}{mn} \sum_{i=1}^m \sum_{j=1}^n I (A_i B_j)$$

where m, n represent the number of sites in each group being compared.

A dendrogram was then constructed showing the relationships between study sites.

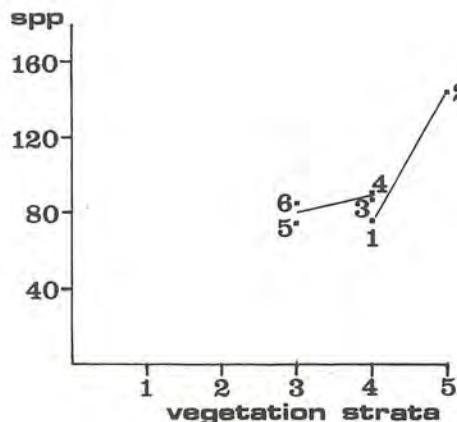


Figure 4. Relationship between number of species and number of storeys of vegetation. Site numbers are shown in the figure; they are as follows:
 Site 1 : Doi Inthanon (summit);
 Site 2 : Doi Inthanon at Mae Chaem;
 Site 3 : Doi Pui;
 Site 4 : Pa Dum - Puping Palace;
 Site 5 : Pa Lad, on side of Doi Suthep;
 Site 6 : Chiang Mai University campus at foot of Doi Suthep.

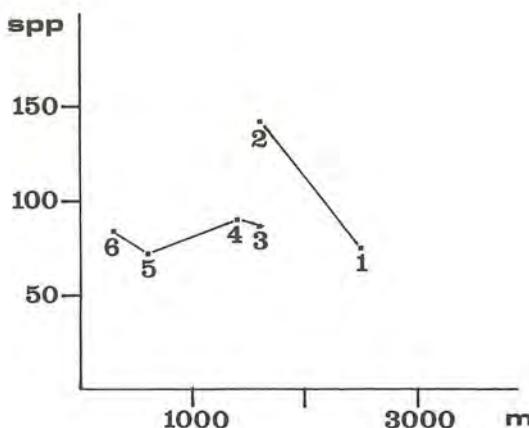


Figure 5. Number of bird species in relation to elevation for the six sites (see Fig. 4). Sites within each mountain range are connected by lines.

R E S U L T S

Species Composition

The study areas have a total avifauna of 33 families, 120 genera, and 237 species, 193 of which are resident and 44 are visitors. The species richness varied among the study sites (Table 1). The highest peak, Doi Inthanon (site 1), had 76 bird species while site 2 had 143 species. Eighty-seven species were found near the summit of Doi Pui (site 3) while Doi Suthep, Pa Lad and the transition area between the mountain and the plain (sites 4-6) yielded 90, 74 and 84 species, respectively (Table 1). Among these, 102 species were judged to be rare, 106 were found more frequently, and 29 species were common. Included were two new records: Dusky Thrush (*Turdus naumannni eunomus*) which was confirmed by Mr. P.D. Round and the Chestnut Thrush (*Turdus rubrocanus*), identified by Dr. Narit Sritaswan (ROUND, 1983; SRITASUWAN & BEAVER, 1982).

Table 1. The numbers of families, genera, and species of birds in the study areas.

Study Areas	Elevation (m)	Families	Genera	Species
1. Doi Inthanon (summit)	2500-2590	19	47	76
2. Doi Inthanon (Mae Cham)	1600-1700	29	75	143
3. Doi Pui	1600-1685	20	48	87
4. Pa Dum-Puping Palace	1400-1600	21	51	90
5. Pa Lad	500-670	20	53	74
6. Foot of Doi Suthep C.M.U.	300	28	62	84

The foot of Doi Suthep-Chiang Mai University (site 6), which is greatly disturbed by man, has more bird species than Pa Lad, the adjoining site. Some birds such as Grey-eyed Bulbul (*Hypsipetes propinquus*) and Black Bulbul (*Hypsipetes madagascariensis*) are obligate forest species which can utilise the forest/cultivation ecotone while others such as the Black-capped Bulbul (*Pycnonotus aurigaster*) and Yellow-bellied Sunbird (*Nectarinia jugularis*) are widespread and common in open country.

Species richness is crudely related to the complexity (number of storeys) of the habitats and to elevation. The relationships between species number and these two factors are shown in Figs. 4 and 5. The number of species increases with the number of storeys and with increasing elevation for Doi Pui-Suthep. The numbers of species for sites 3 and 4 are greater than for sites 5 and 6. For Doi Inthanon, the number of species increases with the number of storeys of vegetation but decreases with elevation above 1600 m.

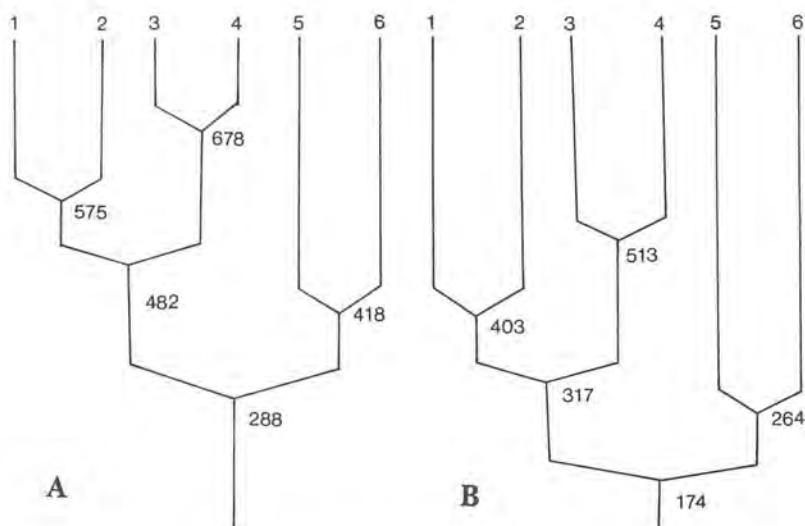


Figure 6. Dendograms showing similarities between bird communities at the six sites (see Fig. 4). Numbers at branching points are similarity indices $\times 100$. Dendrogram A based on index I_s ; dendrogram B based on index I_j (see text).

Similarity Among the Study Areas

The patterns of similarity derived from the two indices are similar (Fig. 6). The bird communities are clearly classified into two ranges and three different elevations. The first range contains the summit of Doi Inthanon-Mae Chaem (1600–2590 m elevation); finally, the lower elevations of Pa Lad-Chiang Mai University campus (300 m elevation) form a separate branch. All four upper elevation forest sites (sites 1–4), showed greater similarity to each other (similarity indices 482 and 317) than they did to the lower elevation drier forest (site 5) and the forest/cultivation ecotone (site 6; similarity indices 288 and 174; Fig. 6).

The bird species composition of the sites within the same range is more similar than that between different ranges. Consequently, the sites of the higher elevations of the same range are firstly grouped together, ie., sites 1–2 of Doi Inthanon and sites 3–4 of Doi Pui-Suthep. Sites 3 and 4 are more similar to each other (similarity index 678 or 513) than are sites 1 and 2 (similarity index 575 or 403).

DISCUSSION AND CONCLUSIONS

It was postulated that the particular species which occur at the sites and the proportions in which they occur would be related to the environments of the sites. Furthermore, the number of species represented should reflect the complexity of the environment. The evidence tends to support these statements. The results of this study agree with those of MACARTHUR (1964).

On Doi Suthep-Pui the number of species increases with number of storeys and elevation, suggesting that climatic factors related to elevation cause differences in the forest structure and the plant species associations so reflected in the avifauna present in the habitats. The number of storeys generally increases with elevation on this mountain. Patchy habitats (sites 4 and 6) which resulted from disturbance by man also tend to have higher bird diversity than sites with more homogeneous forest structure (sites 3 and 5, respectively).

On Doi Inthanon, the highest elevations near the summit have fewer bird species than intermediate elevations (1600 m). Forests near the summit are somewhat less tall and less complex than those lower down.

Site 2 on Doi Inthanon has more bird species than similar elevations on Doi Suthep-Pui. Doi Inthanon probably has a greater faunal diversity because of its greater montane area. Not only is the area of habitat at the same elevation larger but also Doi Inthanon rises to 2590 m. Some high elevation species could disperse to their lower altitudinal limits at or around site 2. Doi Pui is a smaller, more isolated mountain, with its summit at 1685 m. The Red-headed Laughing Thrush, *Garrulax erythrocephalus*, for example, which normally ranges from 2590 m down to approximately 1500 m, is common on Doi Inthanon at 1600 m but absent from Doi Pui at this elevation.

In addition, the habitat at 1600 m on Doi Inthanon (site 2) is richer and more complex than at Doi Pui (site 3) even though these parameters were not evident from a simple assessment of the number of vegetation strata. On Doi Inthanon, the topography was less steep and there were many moist areas, and shady streams. The climate here enriches the epiphytes which some particular bird species, such as *Alcippe castaneiceps*, depend on.

The similarity analysis shows that sites 3-4 and 5-6 on Doi Suthep-Pui are grouped into two different bird communities, the higher elevation forest and the lower elevation drier forest and forest/cultivation ecotone, respectively. The relatively lower similarity index between sites 5 and 6 than between sites 3 and 4 may due to the high degree of disturbance by man on the university campus. Site 3 is adjacent to site 4 and site 5 is adjacent to site 6, so the bird community reflects the differences of the character of the habitats.

Though the number of species found at the two sites of Doi Inthanon were obviously different, site 1 nonetheless grouped with site 2 rather than with site 3 which had a closer number of species. This is because the number of species shared by sites 1 and 2 was greater than that shared by sites 1 and 3.

Groups of species characteristic of particular groups of sites can be distinguished especially with regard to major type of habitat. These groups are presumably responding in a similar way to a particular combination of environmental factors. There is evidence that the distribution of bird species is influenced by their food preferences and the structure of the habitat. Birds eating fruits and nectar were observed moving from one part of the forest to another where trees were

blooming or bearing fruits. The same flocks fed on the trees every day until the food source was depleted; then they moved to others where food was available. Also, some birds migrated from a burned nearby forest area to a denser small patch of forest on the university campus (Emerald Dove, Greater Green-billed Makoha).

Man's activities have also affected the physical and biological properties of the environment. These altered properties also relate to the structure and plant associations of the habitat, which is reflected in the bird communities. Therefore, It is clear that one way to conserve the country's avifauna is to have proper habitat management.

The following general conclusions can be made :

1. Species richness varies among the study sites. Elevations of 1400 – 1600 m tend to have the highest species diversity on both mountain areas studied. The forest is relatively moist and tall, and fairly extensive, at these elevations.
2. Doi Inthanon has the highest diversity, probably because its forest area is larger, and has higher altitude species not present on Doi Suthep.
3. The species compositions of the mountain sites show strong affinities, showing the effects of common ecological factors related to elevation.
4. The two lowland sites show affinity, though this is weak because of the high degree of habitat disturbance on the campus of Chiang Mai University.
5. Man's activities affect the number of bird species present in the habitats.

A C K N O W L E D G E M E N T S

The National Research Centre of Thailand has provided funding for these studies. The Department of Biology, Chiang Mai University, provided necessary equipment and facilities. My thanks are also extended to Dr. W. Brockelman for his valuable comments and to Mr. P. Round for checking the bird list, identifying the Dusky Thrush and giving valuable comments.

R E F E R E N C E S

KÜCHLER, A.W. & J.O. SAWYER, Jr. 1967. A study of the vegetation near Chiang Mai, Thailand. *Trans. Kansas Acad. Sci.* **70** (3) : 281-348.

LEKAGUL, B & E.W. CRONIN. 1974. *Bird Guide of Thailand*. Bangkok : Ladprao Press.

MACARTHUR, R.H. 1964. Environmental factors affecting bird species diversity. *Amer. Nat.* **98** : 387-398.

MOUNTFORD, M.D. 1962. An index of similarity and its application to classificatory problems. Pages 43-50 in P.W. MURPHY (ed.), *Progress in Soil Zoology*.

ROBBINS, R.G. & T. SMITINAND. 1966. A Botanical Ascent of Doi Inthanon. *Nat. Hist. Bull. Siam Soc.* **21** : 205-227.

ROUND, P.D. 1983. Some recent bird records from northern Thailand. *Nat. Hist. Bull. Siam Soc.* **13** (2) : 123-138.

SOUTHWOOD, T.R.E. 1978. *Ecological Methods*. London : Methuen & Co. Ltd., 337-344.

SRITASUWAN, N. & O. BEAVER. 1982. The distribution of bird species at some localities in Chiang Mai (in Thai). *Science (Thailand)*, 36 (1) : 924-930.

Appendix. Distribution of birds in study areas. Sites are as follows:

Site 1 : Doi Inthanon (summit)
 Site 2 : Doi Inthanon (Mae Chaem)
 Site 3 : Doi Pui
 Site 4 : Doi Suthep (Pa Dum-Puping Palace)
 Site 5 : Pa lad
 Site 6 : Foot of Doi Suthep-Chiang Mai University

* = rare species, not often found or only few individuals found;
 ** = species found more often and in moderate numbers;
 *** = common species, found often and in greater numbers.

S = status; V = visitor; RV = some are resident and some are migrants;
 R = resident; ? = possible new record; + = present; - = absent.

Family and common name	Scientific name	Site						S
		1	2	3	4	5	6	
ACCIPITRIDAE								
Black Shouldered Kite	<i>Elanus caeruleus</i>	-	-	-	-	+	**	R
Brahminy Kite	<i>Haliastur indus</i>	-	-	-	+	-	**	R
Crested Goshawk	<i>Accipiter trivirgatus</i>	+	+	-	+	-	*	R
Shikra	<i>A. badius</i>	-	-	+	+	-	**	R
Black Baza	<i>Aviceda leuphotes</i>	-	+	-	+	-	*	R
Black Eagle	<i>Ictinaetus malayensis</i>	+	+	+	-	-	*	R
FALCONIDAE								
Red-Thighed Falconet	<i>Microhierax caerulescens</i>	-	+	-	-	-	*	R
PHASIANIDAE								
Rufous-Throated Tree Partridge	<i>Arborophila rufogularis</i>	+	+	-	-	-	*	R
COLUMBIDAE								
Wedge-tailed Green Pigeon	<i>Treron sphenura</i>	-	+	-	-	-	*	R
Thick-billed Green Pigeon	<i>T. curvirostra</i>	-	-	+	-	-	*	R
Oriental Turtle Dove	<i>Streptopelia orientalis</i>	-	-	-	-	+	*	R
Mountain Imperial Pigeon	<i>Ducula badia</i>	+	+	-	-	-	***	R
Rock Pigeon	<i>Columba livia</i>	-	-	-	-	+	**	R
Ashy Wood Pigeon	<i>C. pulchricollis</i>	+	+	-	-	-	**	R
Barred Cuckoo Dove	<i>Macropygia unchall</i>	+	+	-	-	-	*	R
Spotted Necked Dove	<i>Streptopelia chinensis</i>	-	+	-	-	-	+	R
Emerald Dove	<i>Chalcophaps indica</i>	-	+	-	-	+	+	R
CUCULIDAE								
Large Hawk Cuckoo	<i>Cuculus sparverioides</i>	-	+	-	+	-	**	R
Plaintive Cuckoo	<i>Cocomantis merulinus</i>	-	-	-	-	+	**	R
Emerald Cuckoo	<i>Chrysococcyx maculatus</i>	-	+	+	+	-	*	R
Greater Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	-	-	+	+	+	*	R

Family and common name	Scientific name	Site						S
		1	2	3	4	5	6	
Red-rumped Swallow	<i>H. daurica</i>	—	+	—	—	—	+	*** R
ARTAMIDAE								
Ashy Wood Swallow	<i>Artamus fuscus</i>	—	—	—	—	—	+	* R
ALAUDIDAE								
Rufous-winged Bush Lark	<i>Mirafra assamica</i>	—	—	—	—	—	+	* R
MOTACILLIDAE								
Richard's Pipit	<i>Anthus novaeseelandiae</i>	—	—	—	+	—	+	* R
Forest Wagtail	<i>Dendronanthus indicus</i>	—	—	—	—	—	+	* V
LANIIDAE								
Brown Shrike	<i>Lanius cristatus</i>	—	+	—	—	—	+	** V
Grey-backed Shrike	<i>L. tephronotus</i>	—	+	—	—	—	—	** V
Black-headed Shrike	<i>L. schach</i>	—	+	—	—	—	+	** R
CAMPEPHAGIDAE								
Bar-winged Flycatcher-Shrike	<i>Hemipus picatus</i>	—	+	—	+	—	—	* R
Large Wood Shrike	<i>Tephrodornis virgatus</i>	—	+	—	—	—	—	* R
Indochinese Cuckoo-Shrike	<i>Coracina polioptera</i>	—	+	—	—	—	—	* R
Black-winged Cuckoo-Shrike	<i>C. melaschista</i>	—	+	—	+	—	+	* R
Rosy Minivet	<i>Pericrocotus roseus</i>	—	+	+	—	—	—	* V
Small Minivet	<i>P. cinnamomeus</i>	—	—	—	—	+	—	*** R
Mountain Minivet	<i>P. solaris</i>	—	+	+	+	+	+	*** R
Short-billed Minivet	<i>P. brevirostris</i>	—	+	+	+	—	—	** R
Long-tailed Minivet	<i>P. ethologus</i>	—	+	+	+	+	—	** R
Scarlet Minivet	<i>P. flammeus</i>	—	+	+	+	+	+	*** R
CHLOROPSEIDAE								
Common Iora	<i>Aegithina tiphia</i>	—	—	—	+	+	+	** R
Gold-fronted Leafbird	<i>Chloropsis aurifrons</i>	—	—	—	+	+	+	** R
Blue-winged Leafbird	<i>C. cochinchinensis</i>	—	+	—	+	+	+	** R
Orange-bellied Leafbird	<i>C. hardwickii</i>	—	+	+	+	—	—	** R
PYCNONOTIDAE								
Striated Bulbul	<i>Pycnonotus striatus</i>	+	+	+	—	—	—	* R
Black-headed Bulbul	<i>P. atriceps</i>	—	—	—	—	+	+	*** R
Black-crested Bulbul	<i>P. melanicterus</i>	+	+	+	+	+	+	*** R
Red-whiskered Bulbul	<i>P. jocosus</i>	—	—	—	—	—	+	*** R
Black-capped Bulbul	<i>P. aurigaster</i>	—	—	+	+	+	+	*** R
Flavescent Bulbul	<i>P. flavescens</i>	+	+	+	+	+	—	*** R
Blanford's Bulbul	<i>P. blanfordi</i>	—	—	—	—	—	+	** R
Swinhoe's White-throated Bulbul	<i>Criniger pallidus</i>	—	—	+	+	+	+	** R
Grey-eyed Bulbul	<i>Hypsipetes propinquus</i>	—	—	+	+	+	—	** R
Mountain Bulbul	<i>H. mcclellandii</i>	+	+	+	+	+	—	*** R
Ashy Bulbul	<i>H. flavala</i>	—	+	+	+	+	—	** R
Black Bulbul	<i>H. madagascariensis</i>	+	+	+	+	+	—	*** R

Family and common name	Scientific name	Site						S
		1	2	3	4	5	6	
White-headed Bulbul	<i>H. thompsoni</i>	+	+	-	-	-	*	R
DICRURIDAE								
Ashy Drongo	<i>Dicrurus leucophaeus</i>	+	+	+	+	+	-	*** R
Bronze Drongo	<i>D. aeneus</i>	+	+	+	+	-	-	*** R
Lesser Racket-tailed Drongo	<i>D. remifer</i>	+	+	+	+	-	-	** R
Hair-crested Drongo	<i>D. hottentottus</i>	+	+	-	-	-	-	RV
Greater Racket-tailed Drongo	<i>D. paradiseus</i>	-	-	-	+	+	+	R
ORIOLIDAE								
Black-naped Oriole	<i>Oriolus chinensis</i>	-	-	-	-	+	-	** V
Slender-billed Oriole	<i>O. tenuirostris</i>	-	+	-	-	-	-	** V
Indian Black-headed Oriole	<i>O. xanthornus</i>	-	-	-	+	-	+	R
Maroon Oriole	<i>O. traillii</i>	+	+	+	+	-	-	*
Fairy Bluebird	<i>Irena puella</i>	-	+	-	-	+	-	** R
STURNIDAE								
Ashy-headed Starling	<i>Sturnus malabaricus</i>	-	-	-	-	-	+	*** R
Black-collared Starling	<i>S. nigricollis</i>	-	-	-	-	-	+	** R
Common Myna	<i>Acridotheres tristis</i>	-	-	-	-	-	+	*** R
Crested Myna	<i>A. javanicus</i>	-	-	-	-	-	+	*** R
Hill Myna	<i>Gracula religiosa</i>	-	-	-	+	+	-	*** R
CORVIDAE								
Jay	<i>Garrulus glandarius</i>	-	-	-	+	+	+	** R
Hunting Greenpie	<i>Cissa chinensis</i>	-	+	-	-	+	-	*
Red-billed Blue Magpie	<i>C. erythroryncha</i>	-	-	-	-	+	+	*
Rufous Treepie	<i>Dendrocitta vagabunda</i>	-	-	-	-	-	-	*
Grey Treepie	<i>D. formosae</i>	+	+	+	-	-	-	*
Racket-tailed Treepie	<i>Crypsirina temia</i>	-	-	+	+	+	-	*
Large-billed Crow	<i>Corvus macrorhynchos</i>	-	+	-	-	-	-	*
PARIDAE								
Great Tit	<i>Parus major</i>	-	-	+	+	-	-	** R
Yellow-cheeked Tit	<i>P. spilonotus</i>	+	+	+	+	-	-	** R
Sultan Tit	<i>Melanochora sultanea</i>	-	-	-	-	-	-	** R
SITTIDAE								
Chestnut-vented Nuthatch	<i>Sitta nagaensis</i>	+	+	+	+	+	-	** R
Chestnut-bellied Nuthatch	<i>S. castanea</i>	-	-	+	+	-	-	** R
Velvet-fronted Nuthatch	<i>S. frontalis</i>	-	+	+	+	-	-	** R
CERTHIIDAE								
Brown-throated Tree Creeper	<i>Certhia discolor</i>	+	+	-	-	-	-	*
CINCLIDAE								
TIMALIIDAE								
Yellow-billed Scimitar Babbler	<i>Pomatorhinus schisticeps</i>	-	+	+	-	-	-	*
Red-billed Scimitar Babbler	<i>P. ochraceiceps</i>	-	-	+	-	-	-	*

Family and common name	Scientific name	Site						S
		1	2	3	4	5	6	
Small Wren-Babbler	<i>Napothera epilepidota</i>	-	+	-	+	-	-	**
Pigmy Wren-Babbler	<i>Pnoepyga pusilla</i>	+	+	-	-	+	-	*
Striped Tit Babbler	<i>Macronous gularis</i>	-	-	-	-	+	**	R
Yellow-eyed Babbler	<i>Chrysomma sinense</i>	-	-	-	-	+	**	R
Red-capped Babbler	<i>Timala pileata</i>	-	-	-	-	+	**	R
Lesser Necklaced Laughing Thrush	<i>Garrulax monileger</i>	-	-	-	-	-	*	R
White-crested Laughing Thrush	<i>G. leucolophus</i>	-	-	+	+	+	-	R
Brown-breasted Laughing Thrush	<i>G. strepitans</i>	-	+	-	+	-	-	R
Black-throated Laughing Thrush	<i>G. chinensis</i>	-	+	-	-	-	*	R
Red-headed Laughing Thrush	<i>G. erythrocephalus</i>	+	+	-	-	-	*	R
Silver-eared Mesia	<i>Leiothrix argentauris</i>	-	+	+	-	+	-	R
Red-winged Shrike-babbler	<i>Pteruthius flaviscapis</i>	+	+	+	+	-	**	R
Chestnut-fronted Shrike-babbler	<i>P. aerobarbus</i>	-	+	+	-	-	**	R
Spectacled Barwing	<i>Actinodura ramsayi</i>	+	+	-	-	-	*	R
Chestnut-tailed Siva	<i>Minla strigula</i>	+	-	-	-	-	**	R
Blue-winged Siva	<i>M. cyanouroptera</i>	-	+	+	-	-	*	R
Striated Yuhina	<i>Yuhina castaniceps</i>	-	+	-	+	-	*	R
White-bellied Yuhina	<i>Y. zantholeuca</i>	-	+	-	-	+	-	R
Chestnut-capped Nun Babbler	<i>Alcippe castaneiceps</i>	+	+	+	-	-	**	R
Grey-cheeked Nun Babbler	<i>A. morrisonia</i>	+	+	+	+	-	**	R
Chestnut-backed Sibia	<i>Heterophasia annectens</i>	+	+	+	+	-	**	R
Black-headed Sibia	<i>H. melanoleuca</i>	+	+	+	-	-	**	R
Long-tailed Sibia	<i>H. picaoides</i>	-	+	-	+	-	**	R
Lesser Shortwing	<i>Brachypteryx leucophrys</i>	-	+	-	-	-	*	R
Blue Shortwing	<i>B. montana</i>	+	+	-	-	-	**	R
TURDIDAE								
Rubythroat	<i>Erithacus calliope</i>	-	-	-	-	+	**	V
Siberian Blue Robin	<i>E. cyane</i>	-	-	-	-	+	-	V
Magpie Robin	<i>Copsychus saularis</i>	-	-	+	+	+	**	R
White-rumped Shama	<i>C. malabaricus</i>	-	-	+	+	+	*	R
Daurian Redstart	<i>Phoenicurus auroreus</i>	+	+	+	+	+	-	V
White-capped Redstart	<i>Chaimarrornis leucocephalus</i>	+	-	-	-	-	*	R
White-bellied Redstart	<i>Hodgsonius phaenicuroides</i>	-	-	-	+	+	*	R
Black-backed Forktail	<i>Enicurus immaculatus</i>	-	-	-	-	+	-	R
Slaty-backed Forktail	<i>E. schistaceus</i>	+	+	-	-	+	-	R
White-crowned Forktail	<i>E. leschenaulti</i>	+	+	-	-	-	+	R
Stonechat	<i>Saxicola torquata</i>	-	-	-	-	-	**	V
Pied Stonechat	<i>S. caprata</i>	-	+	-	+	-	**	R
Grey Bushchat	<i>S. ferrea</i>	+	+	+	+	+	-	V
Chestnut-bellied Rock Thrush	<i>Monticola rufiventris</i>	+	-	-	+	-	-	V
Blue Rock Thrush	<i>M. solitarius</i>	+	-	+	+	+	**	V

Family and common name	Scientific name	Site						S	
		1	2	3	4	5	6		
Blue Whistling Thrush	<i>Myophonus caeruleus</i>	+	+	-	-	+	-	*	R
Siberian Ground Thrush	<i>Zoothera sibirica</i>	+	-	-	+	-	-	*	V
Long-tailed Ground Thrush	<i>Z. dixoni</i>	+	-	+	+	-	-	*	V
Tiger Thrush	<i>Z. dauma</i>	+	+	+	+	-	+	*	R
Grey-winged Blackbird	<i>Turdus boulboul</i>	-	+	+	-	+	+	*	V
Grey-sided Thrush	<i>T. feae</i>	+	-	-	-	-	-	*	V
Dusky Thrush	<i>T. naumanni eunomus</i>	+	+	-	+	-	-		V
Grey-headed Thrush	<i>T. obscurus</i>	+	+	+	+	-	+	*	V
Chestnut Thrush	<i>T. rubrocanus</i>	+	+	+	-	-	-	*	?
SYLVIIDAE									
Golder-spectacled Flycatcher Warbler	<i>Seicercus burkii</i>	-	+	-	+	-	-	**	V
Chestnut-crowned Flycatcher Warbler	<i>S. castaniceps</i>	+	+	-	-	-	-	**	R
Yellow-bellied Flycatcher warbler	<i>Abroscopus superciliaris</i>	-	-	+	-	-	-	**	R
Dusky Willow Warbler	<i>Phylloscopus fuscatus</i>	-	-	-	-	-	+	**	V
Greenish Willow Warbler	<i>P. trochiloides</i>	-	-	+	+	-	-	**	V
Blyth's Willow Warbler	<i>P. reguloides</i>	+	+	-	+	-	-	**	V
White-tailed Willow Warbler	<i>P. davisoni</i>	+	+	+	+	-	-	**	R
Inornate Willow Warbler	<i>P. inornatus</i>	+	+	-	+	+	+	**	V
Lemon-rumped Willow Warbler	<i>P. proregulus</i>	+	+	-	+	-	-	**	V
Ashy-throated Willow Warbler	<i>P. maculipennis</i>	+	-	-	-	-	-	**	R
Orange-barred Willow Warbler	<i>P. pulcher</i>	+	-	+	-	-	-	**	V
Long-tailed Tailorbird	<i>Orthotomus sutorius</i>	-	-	-	-	+	+	**	R
Dark-necked Tailorbird	<i>O. atrogularis</i>	-	-	-	-	+	+	**	R
Mountain Tailorbird	<i>O. cuculatus</i>	-	+	-	-	-	-	**	R
Thick-billed Reed Warbler	<i>Phragmaticola aedon</i>	-	-	-	-	-	+	**	V
Pallas's Grasshopper Warbler	<i>Locustella certhia</i>	-	-	-	-	-	+	**	V
Streaked Grasshopper Warbler	<i>L. lanceolata</i>	-	-	-	-	-	+	**	V
Striated Warbler	<i>Megalurus palustris</i>	-	-	-	-	-	+	**	R
Grey-breasted Prinia	<i>Prinia hodgsonii</i>	-	-	-	-	-	+	***	R
Plain Prinia	<i>P. inornata</i>	-	-	-	-	+	+	**	R
Yellow-bellied Prinia	<i>P. flaviventris</i>	-	-	-	-	+	+	**	R
White-browed Prinia	<i>P. atrogularis</i>	+	+	+	+	-	-	**	R
Streaked Fantail Warbler	<i>Cisticola juncidis</i>	-	-	-	-	-	+	*	R
Slaty-bellied Tesia	<i>Tesia olivea</i>	+	+	-	-	+	-	*	R
Scaly-headed Bush Warbler	<i>Cettia squameiceps</i>	-	+	-	-	+	-	*	V
MUSCICAPIDAE									
Verditer Flycatcher	<i>Muscicapa thalassina</i>	+	+	-	-	-	-	**	R
Red-breasted Flycatcher	<i>Ficedula parva</i>	+	+	-	+	+	+	**	V
Rufous-gorgeted Flycatcher	<i>F. strophiata</i>	+	+	+	+	-	-	**	V
Snowy-browed Flycatcher	<i>F. hyperythra</i>	+	+	-	-	-	-	**	R
Slaty-backed Flycatcher	<i>F. hodgsonii</i>	+	+	+	-	-	-	**	V

Family and common name	Scientific name	Site						S	
		1	2	3	4	5	6		
Little Pied Flycatcher	<i>F. westermanni</i>	+	+	+	+	-	-	**	R
Slaty-blue Flycatcher	<i>F. tricolor</i>	-	-	+	+	-	-	*	V
Sapphire Flycatcher	<i>F. sapphira</i>	+	-	+	+	-	-	*	V
Large Niltava	<i>Niltava grandis</i>	-	+	-	-	-	-	*	R
Blue-and-orange Niltava	<i>N. sundara</i>	+	+	+	+	+	-	*	V
Rufous-bellied Niltava	<i>N. vividia</i>	-	+	+	-	-	-	*	R
Hainan Blue Flycatcher	<i>Cyornis hainana</i>	-	-	+	+	-	-	*	R
Pale Blue Flycatcher	<i>C. unicolor</i>	-	-	+	-	-	-	*	R
Blue-throated Blue Flycatcher	<i>C. rubeculoides</i>	-	-	+	+	-	-	*	R
Rufous-throated Blue Flycatcher	<i>C. banyumas</i>	-	-	+	+	+	-	*	R
Tickell's Blue Flycatcher	<i>C. tickelliae</i>	-	-	+	+	+	+	*	R
Grey-headed Flycatcher	<i>Culicicapa ceylonensis</i>	+	-	+	+	-	-	**	R
Yellow-Bellied Fantail Flycatcher	<i>Rhipidura hypoxantha</i>	+	+	-	-	-	-	***	R
White-throated Fantail Flycatcher	<i>R. albicollis</i>	-	+	+	+	-	-	**	R
Black-naped Monarch Flycatcher	<i>Hypothymis azurea</i>	-	-	+	+	+	-	*	R
Paradise Flycatcher	<i>Terpsiphone paradisi</i>	-	-	-	-	+	-	*	R
NECTARINIIDAE									
Purple Sunbird	<i>Nectarinia asiatica</i>	-	-	-	-	+	-	*	R
Gould's Sunbird	<i>Aethopyga gouldiae</i>	+	+	+	+	-	-	***	V
Green-tailed Sunbird	<i>A. nipalensis</i>	+	-	-	-	-	-	*	R
Black-throated Sunbird	<i>A. saturata</i>	-	+	+	+	-	+	*	R
Streaked Spiderhunter	<i>Arachnothera magna</i>	-	+	+	-	+	-	**	R
DICAEIDAE									
Thick-billed Flowerpecker	<i>Dicaeum agile</i>	-	-	-	-	-	+	**	R
Plain Flowerpecker	<i>D. concolor</i>	-	-	+	+	+	-	**	R
Scarlet-backed Flowerpecker	<i>D. cruentatum</i>	-	-	-	-	+	+	**	R
Fire-breasted Flowerpecker	<i>D. ignipectus</i>	+	+	+	+	-	-	*	R
ZOSTEROPIDAE									
Chestnut-flanked White-eye	<i>Zosterops erythropleura</i>	+	+	-	+	-	-	*	V
Japanese White-eye	<i>Z. japonica</i>	+	+	+	+	+	+	**	V
Oriental White-eye	<i>Z. palpebrosa</i>	-	-	+	-	+	+	**	R
PLOCEIDAE									
Tree Sparrow	<i>Passer montanus</i>	-	-	+	+	+	+	***	R
Baya Weaver	<i>Ploceus philippinus</i>	-	-	-	-	-	+	**	R
Sharp-tailed Munia	<i>Lonchura striata</i>	+	+	-	-	+	+	**	R
Spotted Munia	<i>L. punctulata</i>	-	-	-	-	+	+	***	R
FRINGILLIDAE									
Common Rosefinch	<i>Carpodacus erythrinus</i>	+	-	+	-	-	-	**	V
Spot-winged Grosbeak	<i>Mycerobas melanozanthos</i>	-	+	-	-	-	-	*	R
Little Bunting	<i>Emberiza pusilla</i>	-	+	-	-	-	+	*	V
Chestnut Bunting	<i>E. rutila</i>	-	+	-	-	-	-	*	V